Hydrological functioning of an innovative planted filter for runoff water depollution

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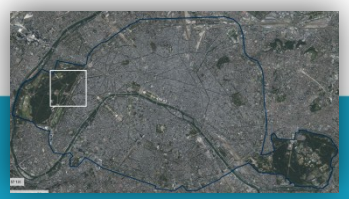
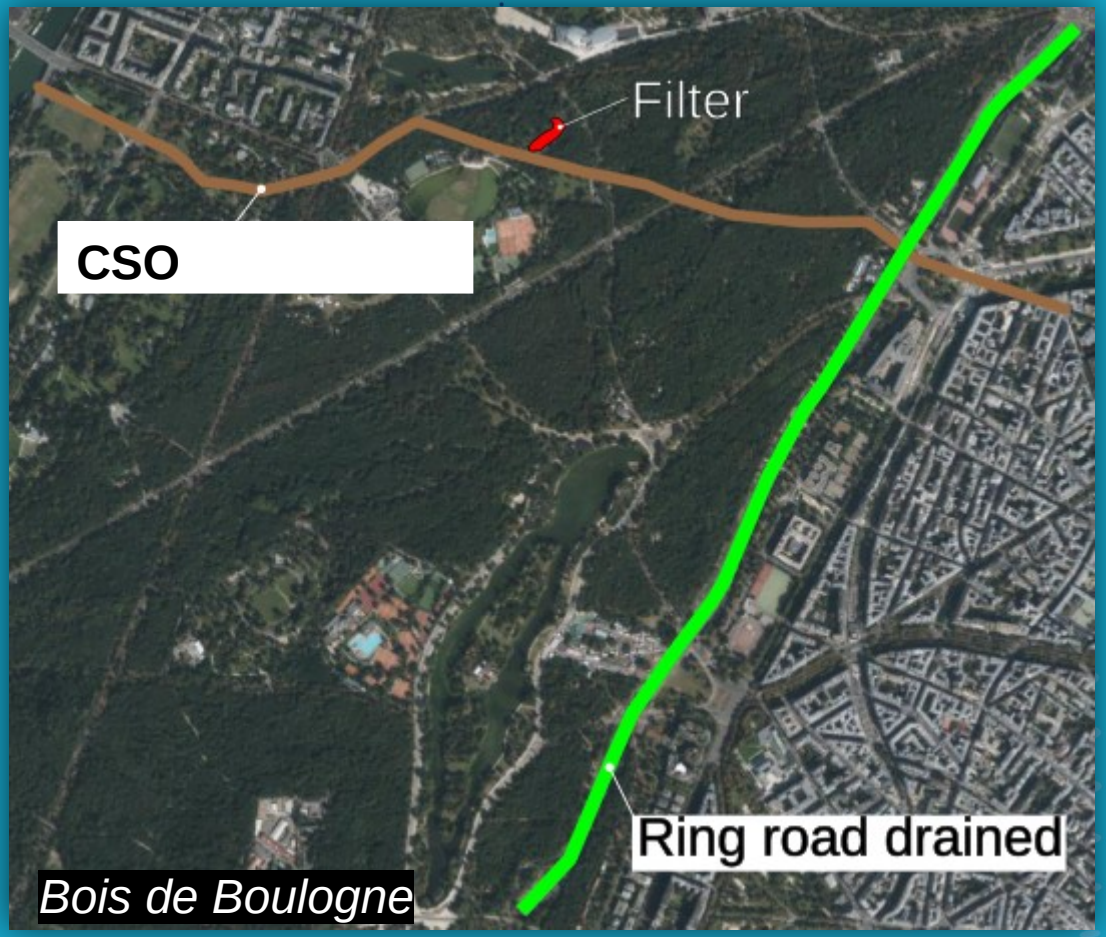
Context

- Runoff water from high traffic roads carries high pollution loads and requires specific treatment.
- This contamination is widely documented for metals and PAH, but significant concentrations of other organic micropollutants have also been reported such as phthalates or alkylphenols.
- Suspended solids (SS) are well known as the main vector of stormwater contamination but dissolved pollution can also be significant and needs a special treatment.

Context / Objectives





- **21 ha** of the Paris ring road (1.3 million vehicles/day) **runoff water is drained** to a combined sewer overflow (« **Bugeaud CSO** »)
- Runoff water is discharged directly into the Seine river

Objectives

1) Test planted filter to clean up runoff water before Seine river
2) Remove dissolved and particulate phases.

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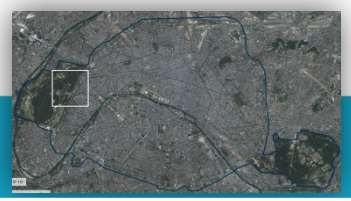

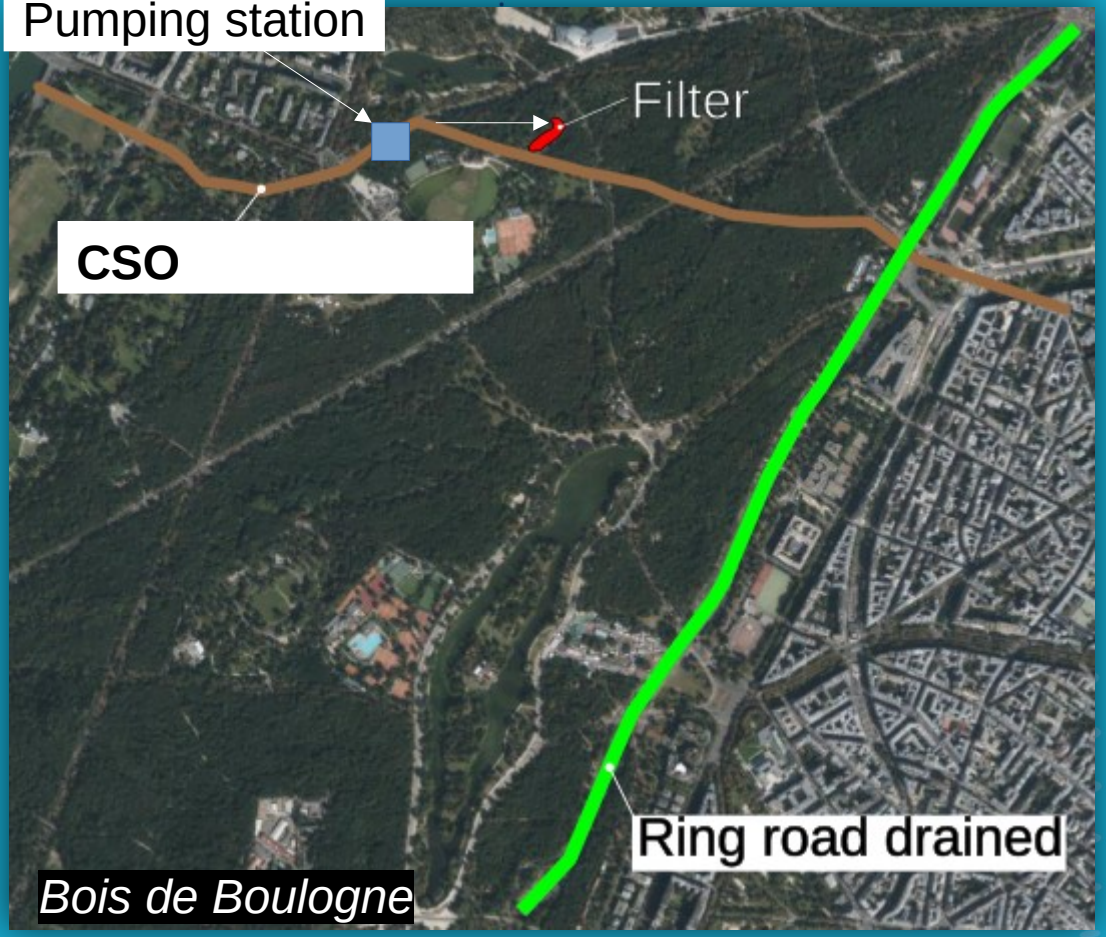

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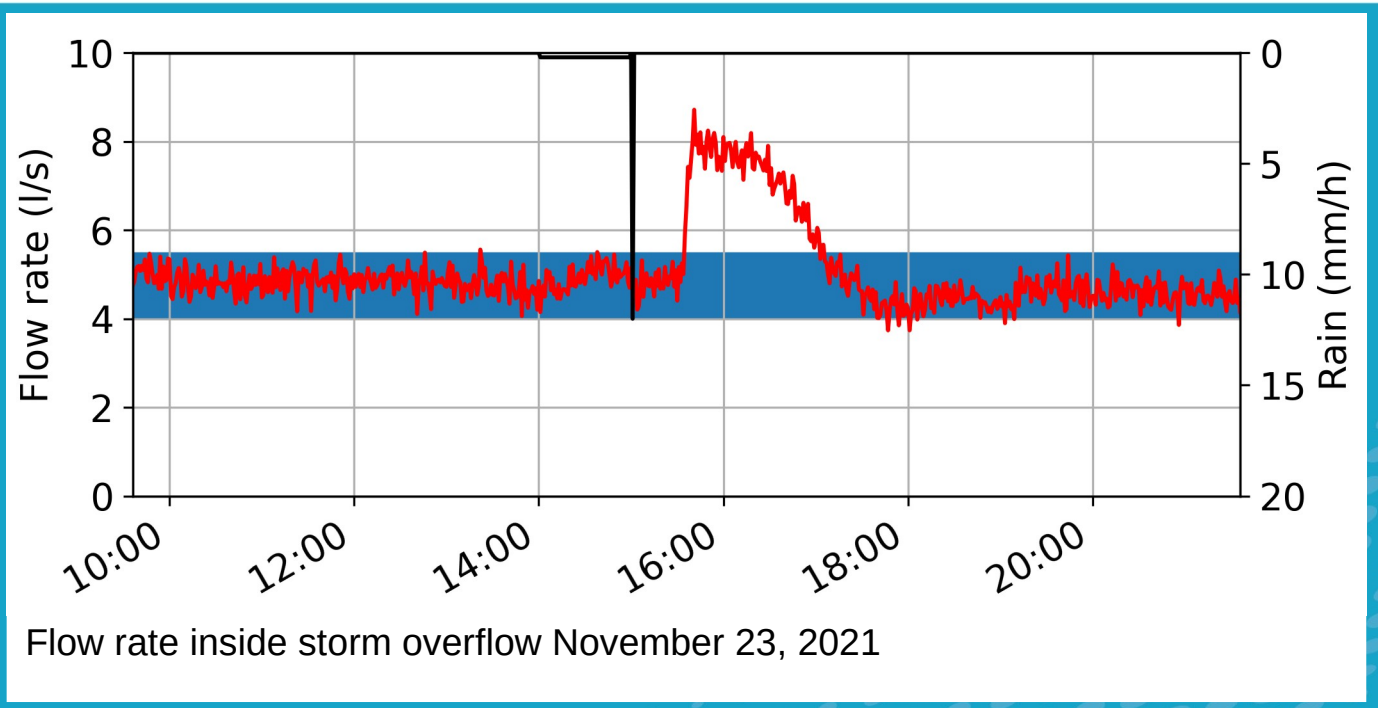
Filter

- **Storm overflow**
- mix of « dry » and rainy weather flow



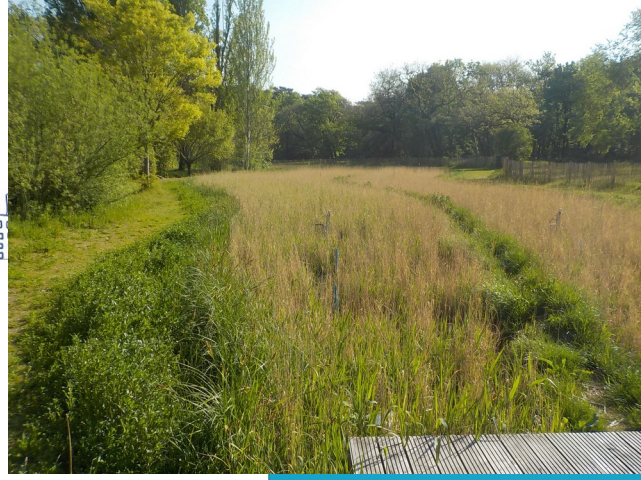
Flow rate inside storm overflow November 23, 2021

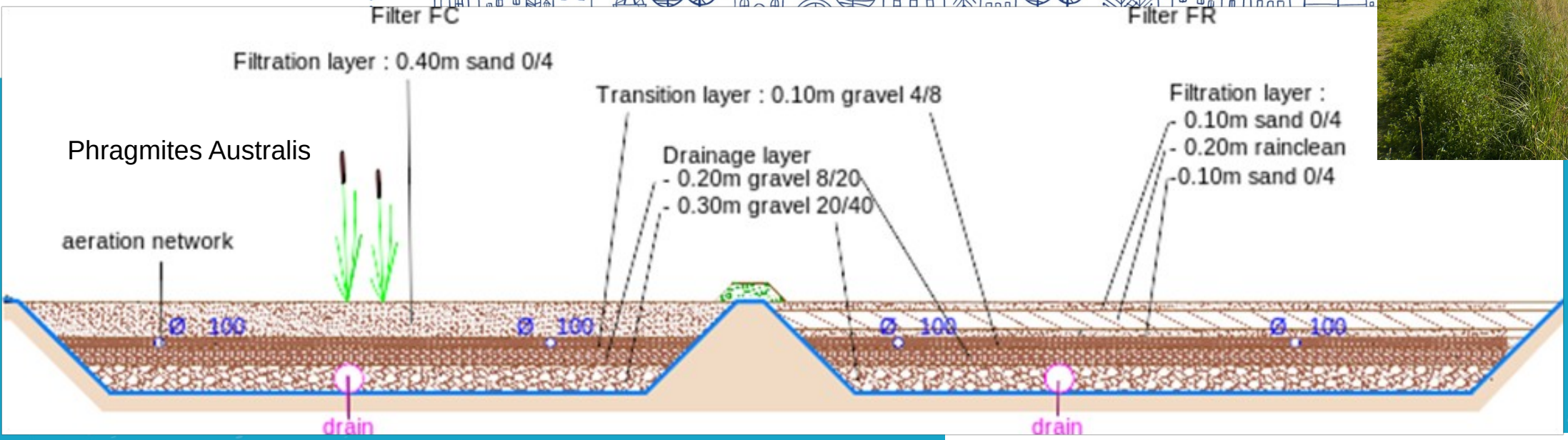
=> Differential filters supply

- **« Dry » weather**
  - water release of 50 m^3 at 40 l/S
- **Rainy weather**
- Water release of 300 m^3 at :
  - 80 l/s up to saturation (5 cm above filter surface)
  - then 40 l/s

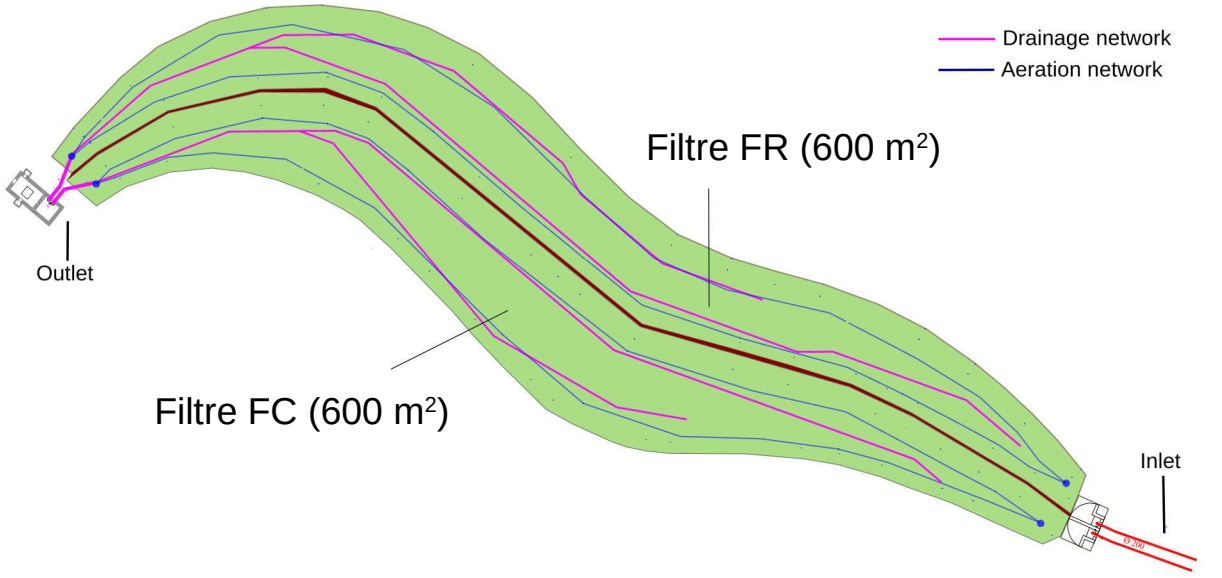
- Filter rotation : **one month**

Filter

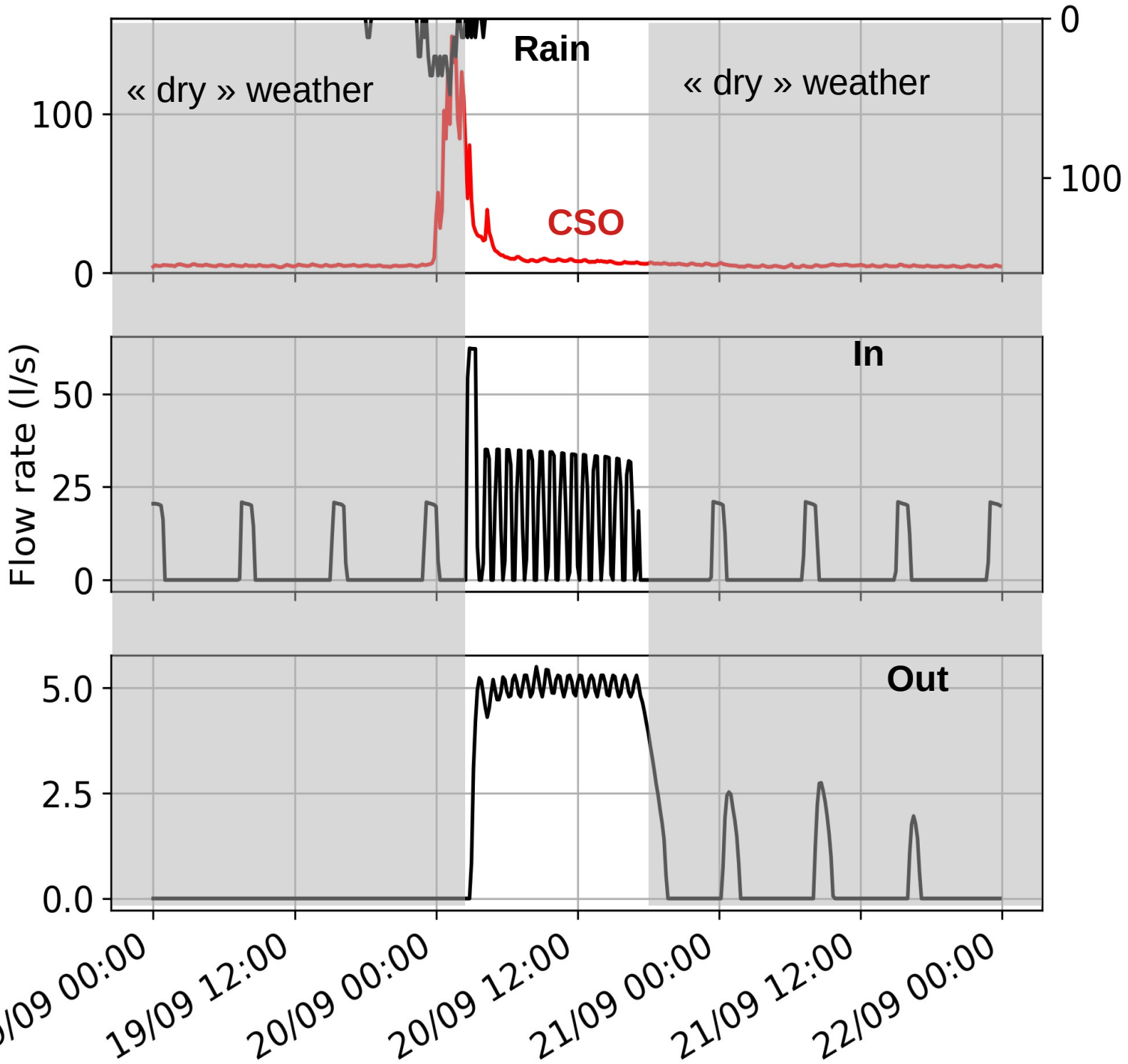




- **FC : classical filter (FC)**
- **FR : filter with Rainclean®**
- **(Funke Kunststoffe GmbH, Hamm, Germany)**



Filter


Rain
« dry » weather
« dry » weather
CSO
100
0
0
100
Rain (mm/h)
In
Flow rate (l/s)
50
25
0
Out
5.0
2.5
0.0
19/09 00:00
19/09 12:00
20/09 00:00
20/09 12:00
21/09 00:00
21/09 12:00
22/09 00:00

Results – water supply

From May 2021 to September 2023

Rain events : 1541 mm
(299 events>1 mm, 12 heavy rainfalls)

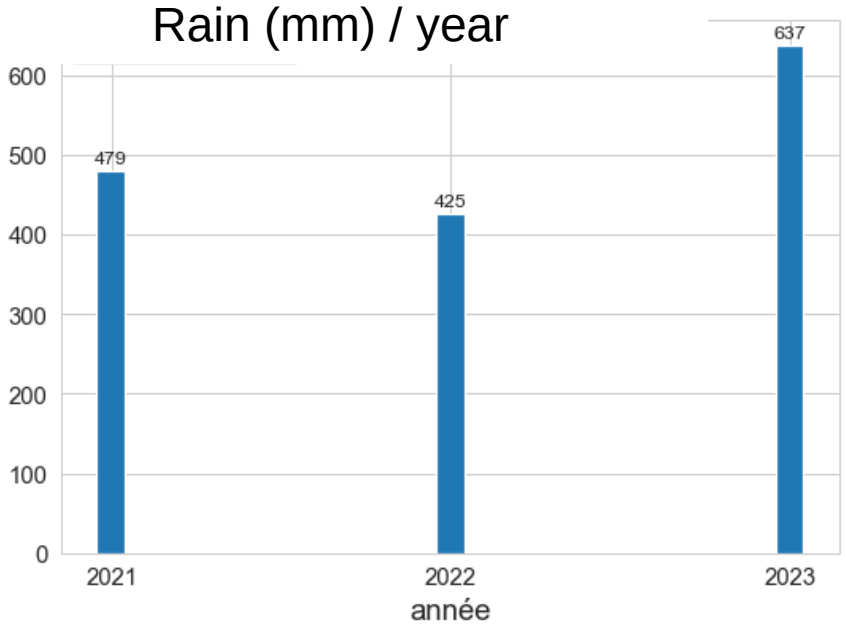
Total volume to FR : 206 030 m³ (343 m)
Total volume to FC : 221 464m³ (369 m)

Rainy weather : 167 days

- FR : 87 days (saturation : 42 days) | 78 914 m³ (131 m/year)
- FC : 80 days (saturation : 38 days) | 84 315 m³ (140 m/year)

« Dry » weather : 711 days

- FR : 356 days 127 116 m³ (212 m/year)
- FC : 355 days 137 149 m³ (229 m/year)



Results – water supply

September 2022, 21. FR – « dry » weather

	CSO	IN	OUT
MES (mg/L)	12	44	5
pH	8.2	8.2	7.6
N-NH4 (mg/L)	0.12	0.38	0.13
N-NO3 (mg/L)	7.44	6.77	6.56
16 PAH (µg/L)	< 0,145 / <0,145	1.8 / 1	< 0,145 / <0,145
E. Coli (germs/100 ml)	25 000	19 000	330 000
Intestinal Enterococcus (germs/100mL)	40 000	58 000	480
Total Coliforms (germs/100mL)	24 000	240 000	240 000
Pb	2,72 / <0,1	12,29 /<0,1	<0,4 / <01

Conclusion

- Two filters tested for water runoff depollution.
- One filter with Rainclean® (Funke Kunststoffe GmbH, Hamm, Germany).
- Three years of observations, still ongoing.
- « Dry » weather volume > Rain events volume.
- Technical difficulties for water quality sample.
- Pollutants removal effectiveness still under study.

Conclusion

- Thanks for your attention !